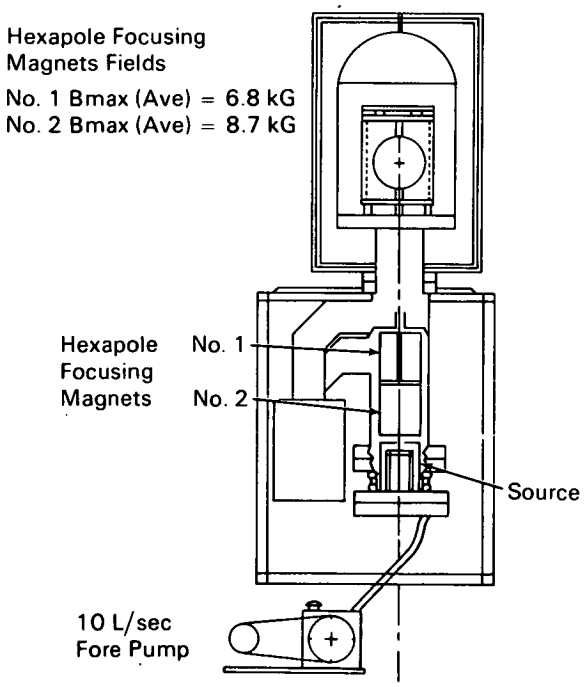
November 1970

Brief 70-10581

NASA TECH BRIEF

Multiple Focusing Magnets Used for Velocity Selection of Atoms

A method has been developed for using computer techniques in calculating velocity selection of hydrogen atoms for use in a maser frequency standard. The computer technique permits the designer to resolve more readily the design problems of multiple focusing magnets employed in atomic velocity selection. In this particular application, excellent agreement has been realized between computer calculations and previously used and extremely time consuming hand calculations in the constant magnetic moment approximation.



Experimental Hydrogen Maser Apparatus

In conjunction with the experimental hydrogen maser device illustrated, computer-integrated trajectories were obtained for several magnet lengths and for source (rf and thermal dissociators) temperatures of 370°K and 2800°K. The computer integrated the atom trajectory through the magnet, using the exact Breit-Rabi formula to determine the force on the atom along the path, for a particular velocity, and with the source located at the entrance of the magnet on-axis. By stepping up the angle and integrating a new trajectory, the program determines the maximum allowable angle for an atom to pass through the focusing magnet and enter the bulb aperture, whose diameter equals that of the magnet aperture and is located at a discrete distance from the end of the magnet. The size of a beam stop located at the end of the focusing magnet is adjusted to prevent undeflected particles from the source (such as hydrogen molecules) from entering the bulb. This stop determines the minimum allowable angle for a good trajectory. The calculation has been repeated for a number of different velocities. The intensity, as determined by the velocity distribution and solid angle, has been computed and the total intensity determined.

Notes:

1. Related information is presented in NASA Tech Brief B67-10146.

(continued overleaf)

2. The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference:
NASA-CR-89275 (N67-39353), Study Improvement of The Hydrogen Maser

Patent status:

No patent action is contemplated by NASA.

Source: Hewlett-Packard Co.
under contract to
Goddard Space Flight Center
(GSC-10128)